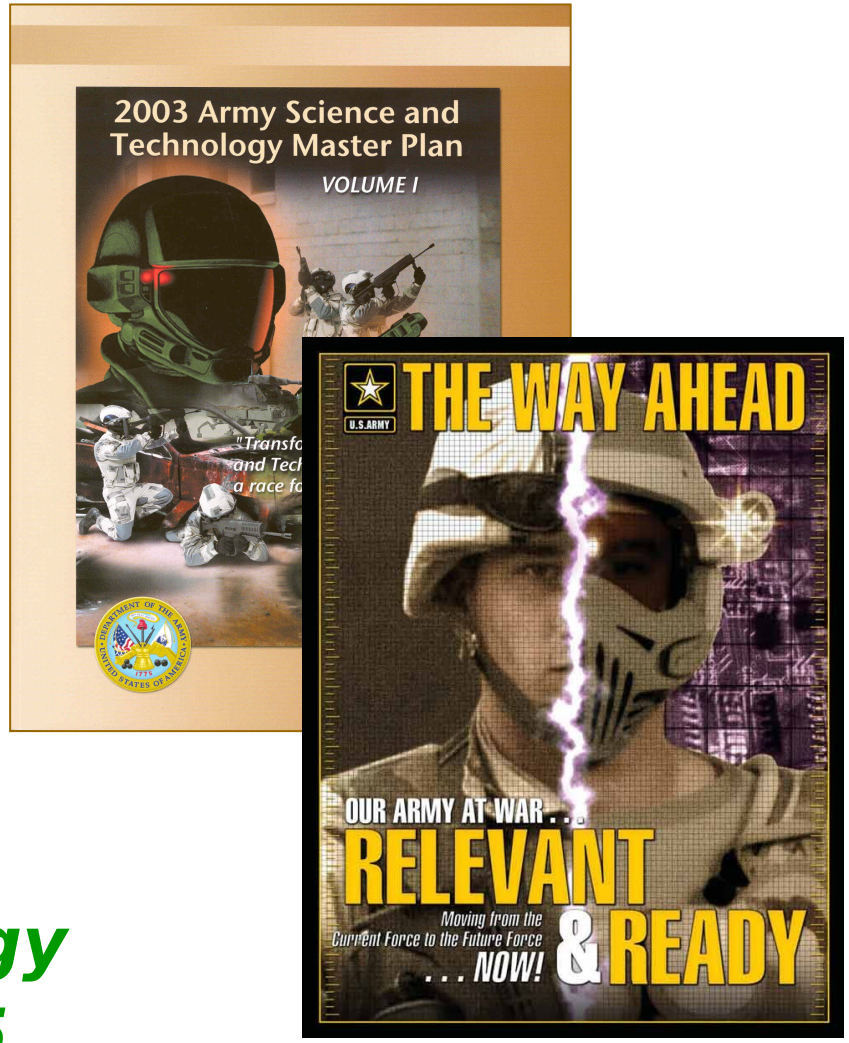

2003 Army Science and Technology Master Plan
VOLUME I
THE WAY AHEAD
U.S.ARMY
OUR ARMY AT WAR . . .
RELEVANT
Moving from the Current Force to the Future Force
. . . NOW!
& READY

DoD Technology Exposition

April 21, 2004

Army Science & Technology Investments for FY 2005

Dennis Schmidt
Director, Science Technology & Integration
Office of the Assistant Secretary for Research & Technology

Topics

- *Transformation goals and funding*
- *Responding to the Global War on Terrorism*
- *Major investment areas*

Pursuing Transformational Capabilities

Smaller, Lighter, Faster—Smarter

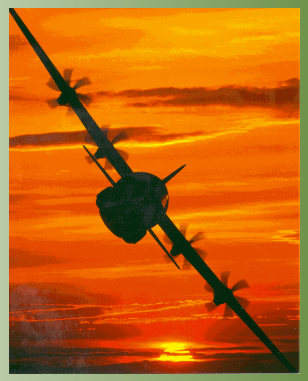
Current Force

~100 lb. load

70+ tons

< 10 mph

From Platforms to System of Systems



C-130-Like Transportability

Future Force

< 40 lb. effective load

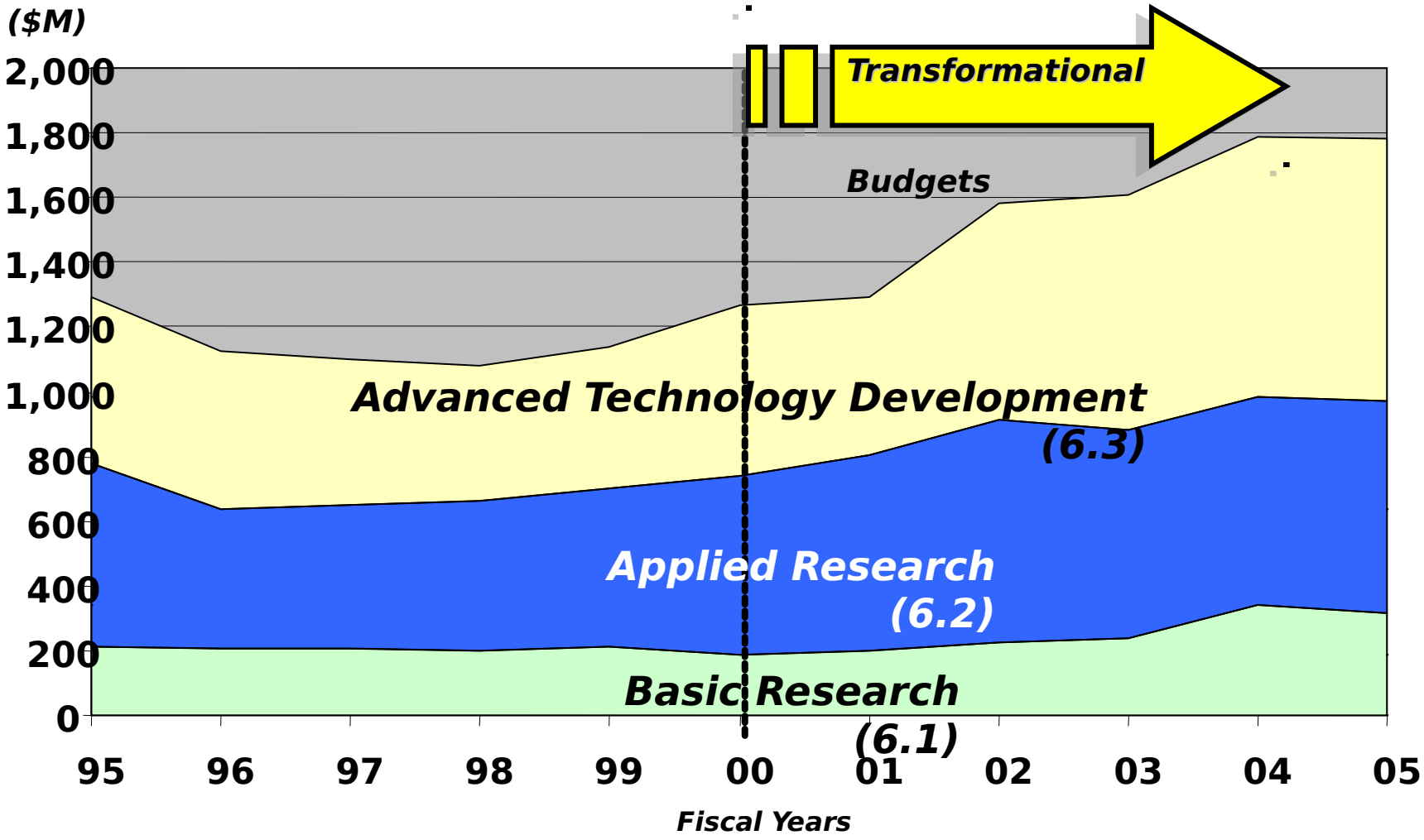
Fully networked

< 20 tons

> 40 mph

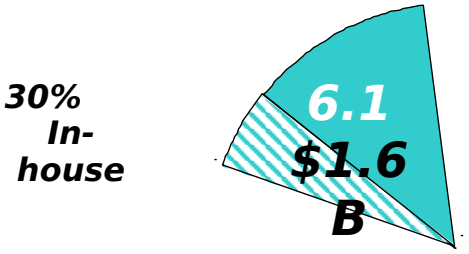
Army S&T Funding Trends

Presidents' Budget Requests



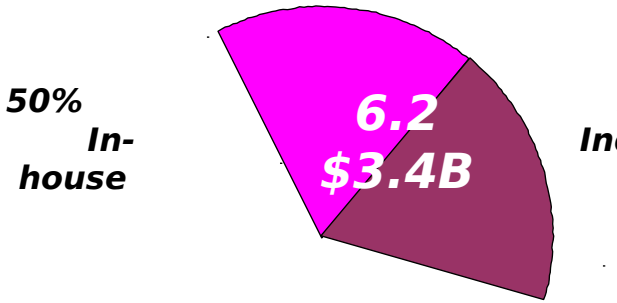
The Business of Science and Technology FY05-09

Basic Research - Imaginable



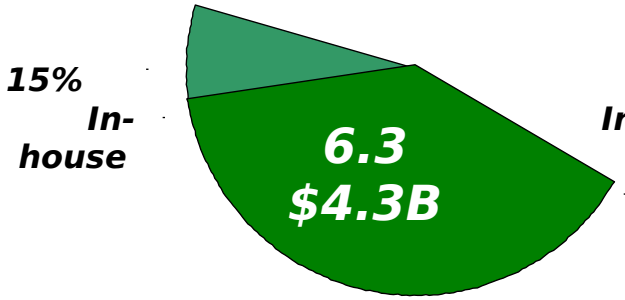
- Basic scientific studies creating knowledge and understanding
- Implemented through university, industry and in-house research
- Exploiting opportunities such as Nanotechnology, Biotechnology and Immersive Environments for Training

Applied Research - Feasible



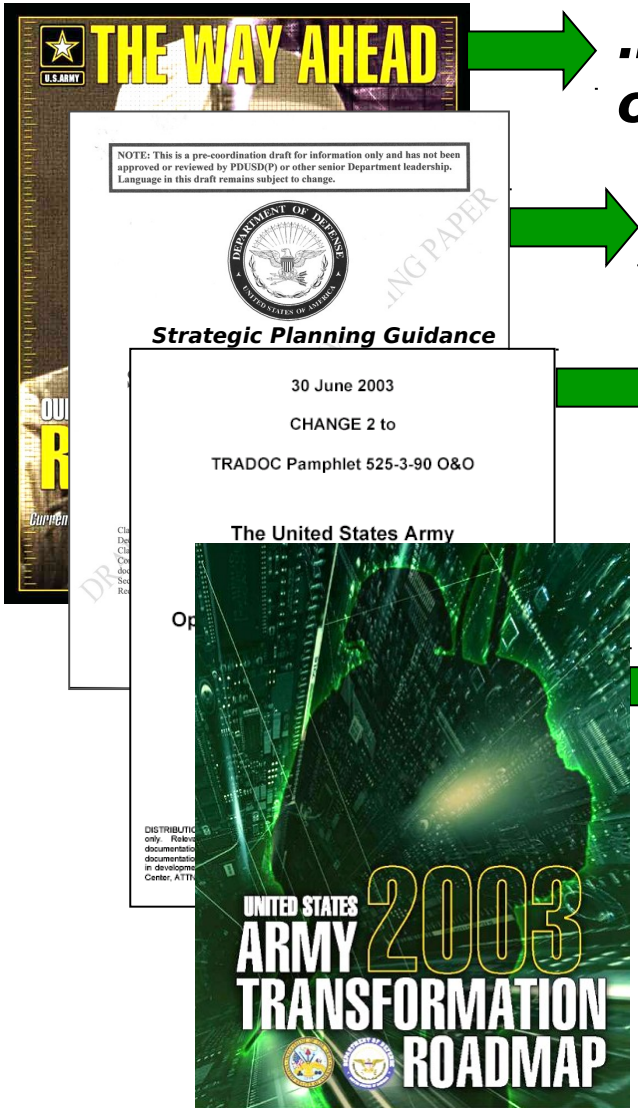
- Transforming knowledge into technology applications
- Implemented through Industry and In-House Research
- Examples include: MEMS IMU, Laser Sources, Autonomous Control Algorithms, Fuel Cell Reforming

Advanced Technology Development - Demonstrable



- Demonstrate tactical feasibility at the system and subsystem level
- Increase Technology Readiness for Rapid Transition to System Development & Demonstration
- Implemented primarily through Industry
- Examples include: Future Force Warrior, GKEM, ITRS Cluster 5 (Soldier

Guidance to Shape the S&T Program


THE WAY AHEAD
U.S.ARMY
NOTE: This is a pre-coordination draft for information only and has not been approved or reviewed by PDUSD(P) or other senior Department leadership. Language in this draft remains subject to change.
Strategic Planning Guidance
30 June 2003
CHANGE 2 to
TRADOC Pamphlet 525-3-90 O&O
The United States Army
UNITED STATES
ARMY 2003
TRANSFORMATION
ROADMAP

… provide for the accelerated fielding of selected Future Force capabilities

… provide relevant and ready land power capability to the Joint Combatant Commander

… we must seek leap ahead enhancements in operational effectiveness not available in the Current Force

… develop a range of complementary and interdependent capabilities that enable future Joint Force Commanders to dominate any adversary or situation

Technologies for GWOT

- ***Armed Predator***
- ***Interceptor Body Armor***
- ***Bar Armor for HMMWVs and Stryker***
- ***Robots (caves and vehicle inspection)***
- ***Counter Mortar Radar***
- ***Uncooled IR Helmet Sensors***
- ***ZEUS (Laser) Mines***

Individual Soldier Protection

7.62 mm round glanced edge of SAPI and embedded in OTV

Interceptor Body Armor is a modular, multi-threat Body Armor using an Outer Tactical Vest (OTV) and Small Arms Protective Insert (SAPI) Plates

- ***Advanced high performance fibers (e.g. Kevlar & Spectra) with lightweight ceramic-based composites for body armor and improved helmet***
- ***Protection:***
  - ***Vest: Fragmentation and 9 mm ball ammunition***
  - ***Inserts: 5.56 mm and 7.62 mm ball ammunition***
  - ***Helmet: Fragmentation and 9 mm ball ammunition***
- ***Weight: Vest - 8.5 lb, 2 Inserts - 8.0 lb, Helmet – 3.2 lb***
- ***Operation Enduring Freedom and Operation Iraqi Freedom***

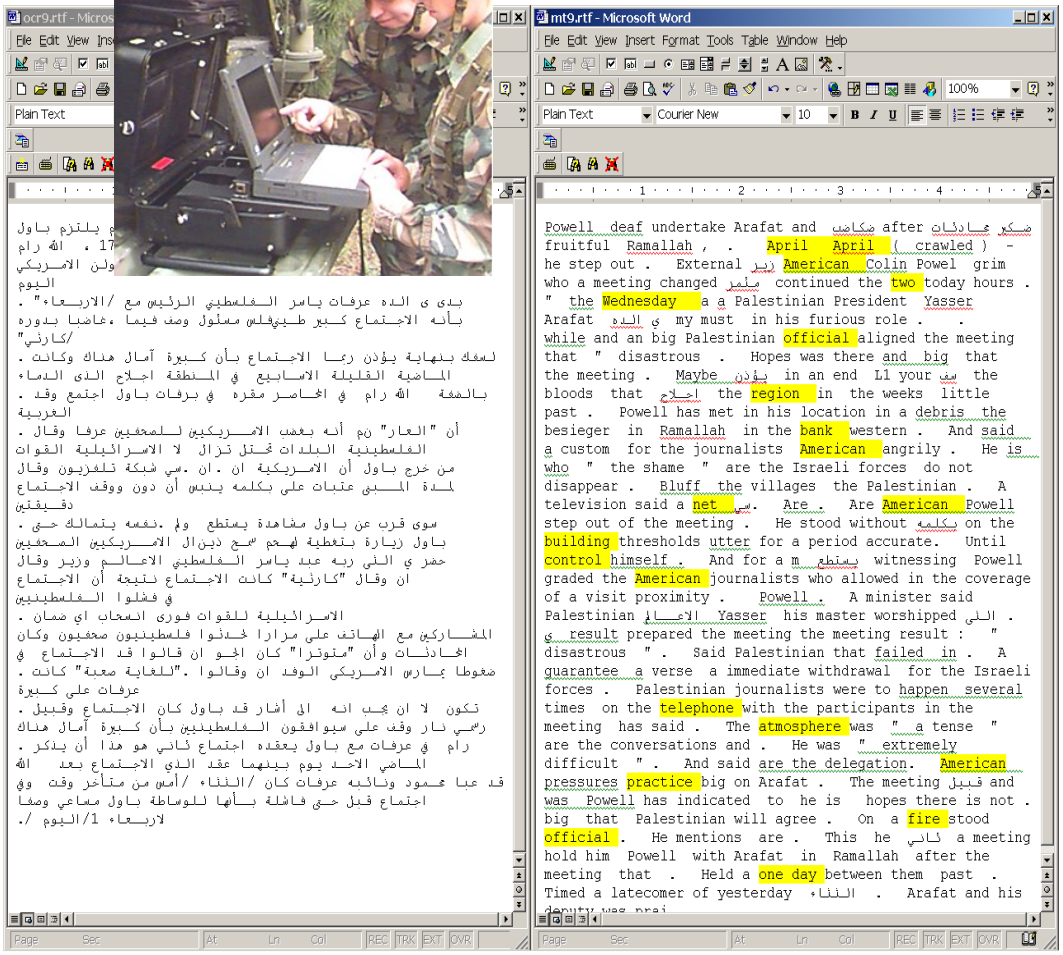
"…We are seeing very few chest wounds and very few head wounds." Colonel David W. Polly, Chief, Department of Orthopedic Surgery and Rehabilitation at the Walter Reed Army Medical Center. Comment for Operation Iraqi Freedom Lessons Learned

Protection for M-1 Abrams
Rear Bar-Armor

- *Operation Iraqi Freedom, several M-1s engine compartments were damaged*
- *Effective armored engine grill was designed, evaluated, built & shipped to Iraq in April by Army/ Industry Team within 7 days of call from field*

Effective solution for improving survivability without degrading engine performance

Forward Area Language Converter (FALCon) - Iraq



- ***FALCon is an integration of optical character recognition (OCR) and machine translation technology in a laptop system***
- ***ARL designed, developed, and delivered FALCon to Intel analysts in theater for document triage***
- ***Original systems translated Baltic languages. Later systems were built to translate Arabic documents, as well as Asian language documents***
- ***Current system has 47***

Chitosan Bandage

HEMCON
HemCon™ Bandage
(Chitosan)
4" x 4"
Instructions for use:
1. Apply dressing with pressure for 1-2 minutes or until dressing adheres and bleeding is stopped.
2. Apply outer bandage to secure dressing on wound site.
3. Remove dressing within 48 hours.
Caution:
For external use only. Do not implant.
Not for consumption. Do not eat.
Single use only. Do not resterilize.
Do not apply over eyes.
Federal law restricts this device to sale by or on the order of a physician.

- ***Reduced bleeding by >80% in animal models***
- ***Only known, Food and Drug Administration-approved, bandage that can stop severe arterial bleeding***
- ***Fielded in Operation Iraqi Freedom***

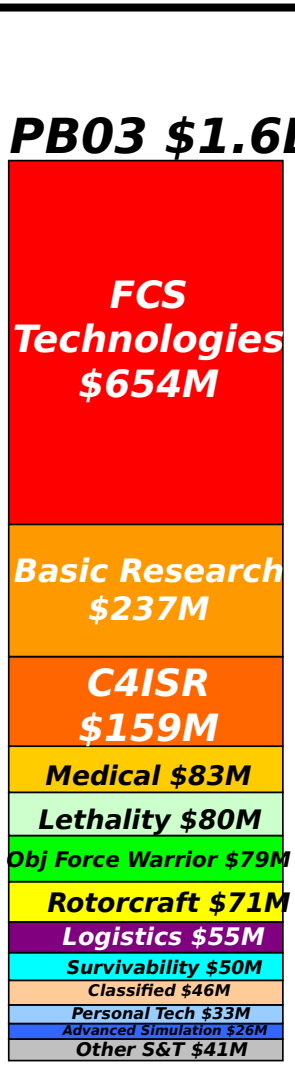
Laser Neutralization System for Unexploded Ordnance (ZEUS)

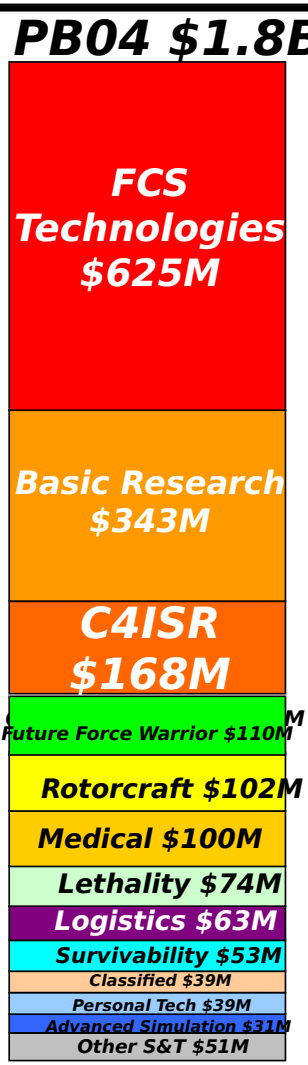
- *Commercial kilowatt class laser integrated on a HUMMWV to neutralize exposed unexploded ordnance (UXO)*

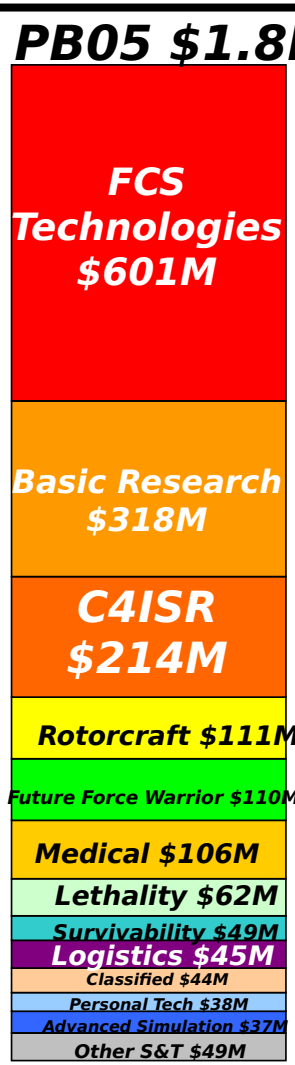
- *Deployed to Afghanistan March—August 2003*
  - *Successfully Neutralized 10 Different Types Of Ordnance Totaling 210 Targets (51 In Less Than 2 Hours, A Record Pace)*
  - *UXO Neutralization Times (5 to 240 sec; < 30 sec Typical)*
  - *25m – 300m Stand*
  - *Self-Contained on*

C130 (17 Mar 03)

Army Science and Technology Portfolio



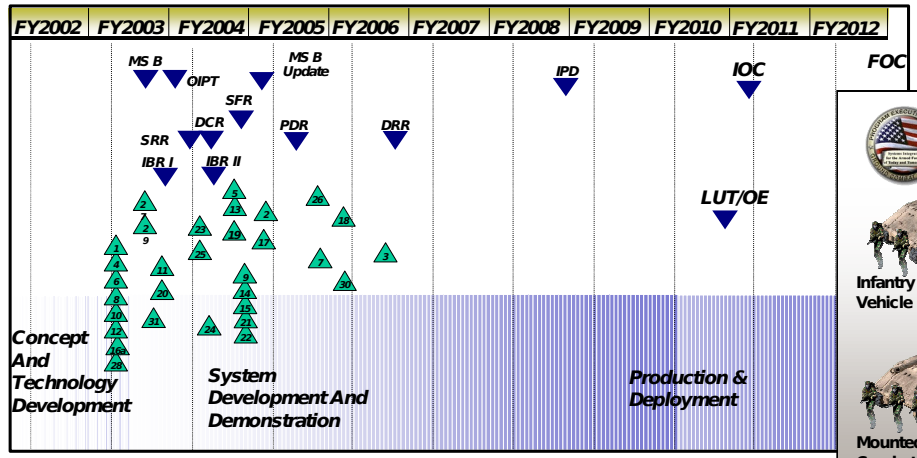




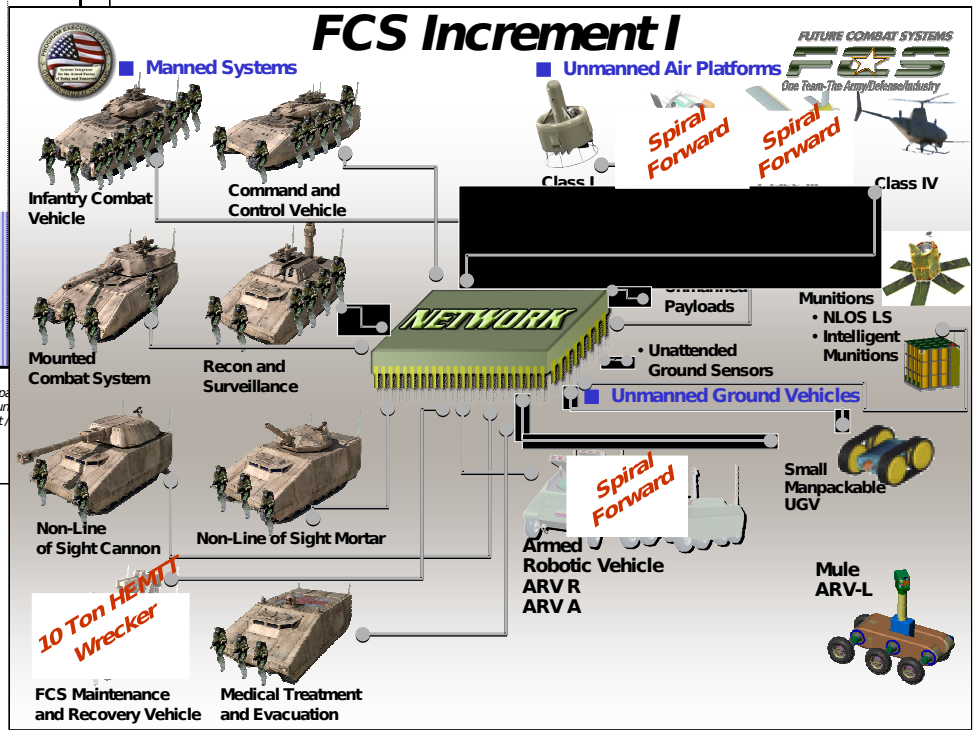
FCS remains the single largest S&T investment

FCS Increment 1 Milestone B May 2003
FY05-09 $2.3B

FCS Master Schedule and Milestones Increment I – Jan 2004



MS B - Milestone B
OIPT - Overarching Integrating Process Team
IOT – Initial Operational Test
IPD – Initial Production Decision
SRR – System Readiness Review
DCR – Design Concept Review
DRR – Design Readiness Review
IBR - Initial Baseline Review
PDR - Preliminary Design Review
FOC – Full Operational Capability
IOC – Initial Operational Capa
SFR – System of System Fun
LUT/OE – Limited User Test /
Evaluation



Technologies for Spiral Insertions

Where we are today? Technologies in the FCS Trade Space

MOSAIC

FCS C2

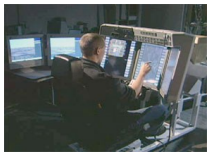
JTRS-SLICE

MRM

LAM

PAM

LtWt 120mm Gun


Crewstation

OCSW

SATCOM OTM

A-160 Hummingbird

Agile Cdr

OT Close-in Active Protection

Adv Armor

MATRE X

Hybrid Electric Drive

Advanced Mobility

AHED

Leader/ Follower Convoy)

Joint Interoperability

Networked Lethality

Networked Battle Command

Key Performance Parameters

Sustainability & Reliability

Survivability

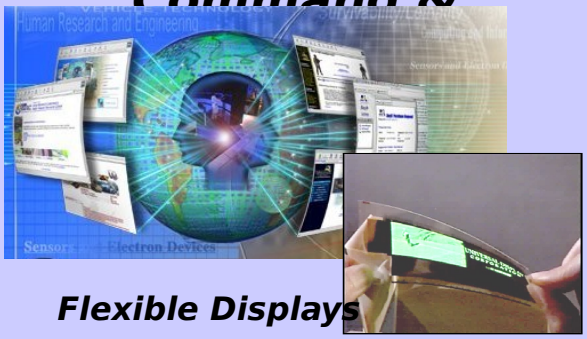
Transportability

Training

Technologies for Full Spectrum FCS

Surveillance and Knowledge Systen
FY05-09 $1.6B

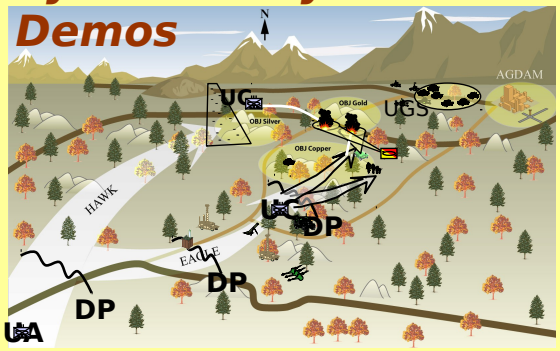
Command &



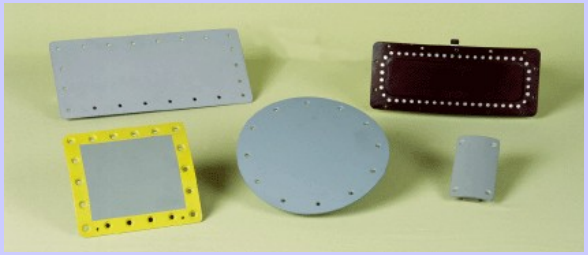
Flexible Displays

Knowledge Fusion

System of Systems Demos



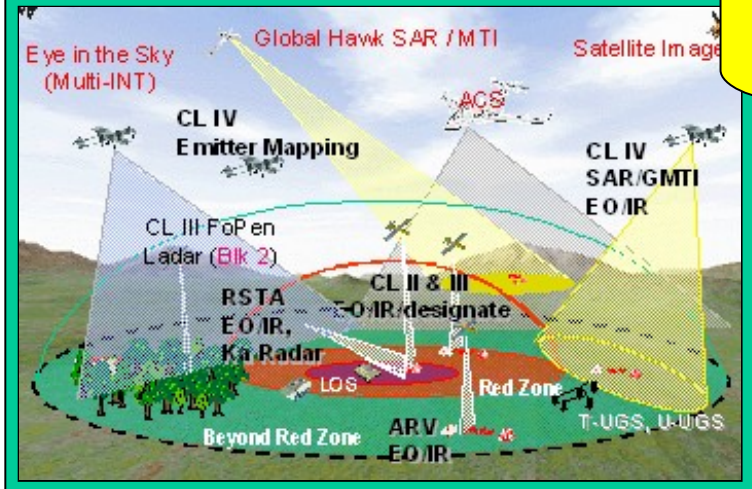
Networked Comms



Conformal Antennas

- Find the Enemy
- Assured Comms
- Battle Command

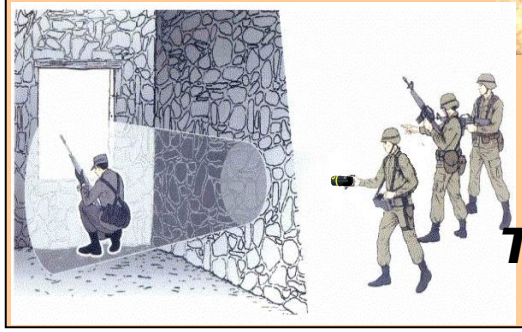
Persistent Sensor



Unblinking "Eye"

Portable SA for the Soldier

Improved MOUT SA



Disposable Sensors

Through Wall Sensing

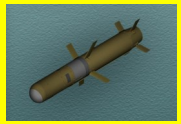
Lethality

FY05-09 $1.3B

Missiles…Extended Range and Loiter with greater Lethality

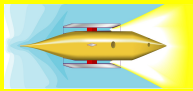
Next Gen NLOS-LS and C3

Loitering Attack Missile (LAM)



Precision Attack Missile (PAM)

Compact Kinet…

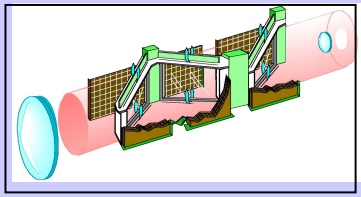


Maintain Lethality w/ Increased Stowed Kills

National Aerospace Initiative - Hypersonics

2x Distance in ½ the Time

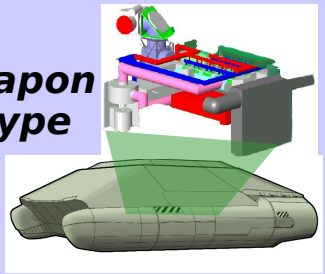
Directed Energy …Tunable Lethality



Solid State Laser (SSL) Technology Development

Speed of Light Engagement

SSL Weapon Prototype

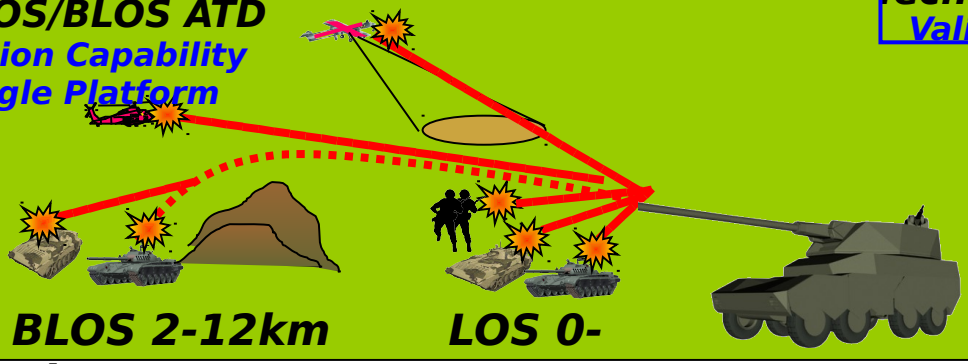


- Precision Strike
- Overwhelming Lethality at Longer Ranges
- Reduced Logistics

Guns and Munitions … One Shot – One Kill

120MM LOS/BLOS ATD

Multi-mission Capability from a Single Platform

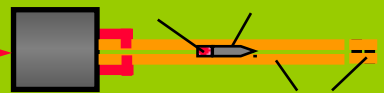


BLOS 2-12km

LOS 0-4km

EM Gun Tech Demo

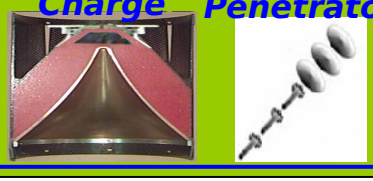
Validate Hypervelocity Lethality



Multi-Purpose Warheads

Conventional Shaped Charge

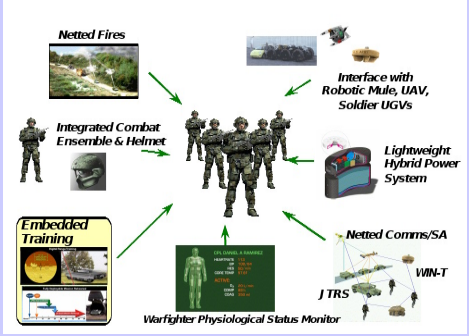
Explosively Formed Penetrator



Technologies for the Soldier

FY05-09 $967M

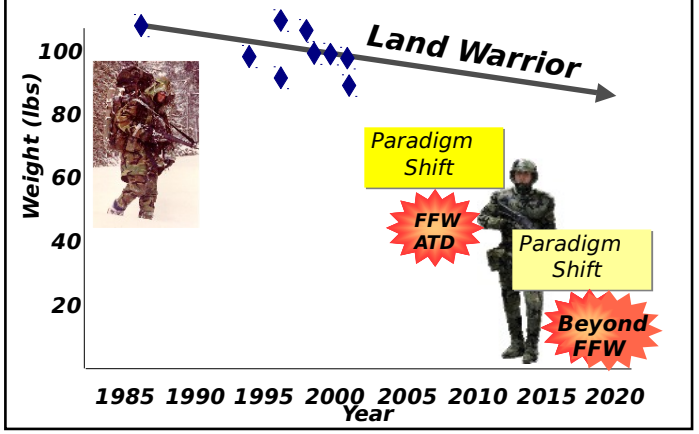
Future Force Warrior



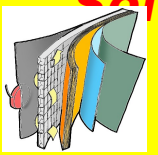
- Dismounted Fighting Ensemble (50lb threshold; 40lb obj)
- Future Force Network Connectivity
- Netted Comms & Fires – Situational Awareness

-System of Systems

Added Capabilities / Reduced Weight



Soldier Performance & Survivability



- Human Factors Engineering
- Nano-based & Multi-functional Materials for Threat Protection
  - Ballistic, Chem/Bio, Laser, Environment, Emerging

Training and Leader Development

- Soldier and Leader Training
- Crewman's Associate

Combat Casualty Care

- Physiological Status Monitoring
- Enhanced Performance
- Hemostatic Dressing
- Medical Mission Package
  - Emergency Room

Unmanned Systems
FY05-09 $850M

Lethality…first shot, first kill

Unmanned Combat Armed Rotorcraft

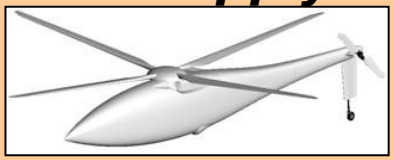
- Autonomous Team Attack LOS/BLOS/NLOS Fire -

Unmanned Ground Vehicle

Logistics…reduced footprint

Soldier Mule

- Autonomous Re-supply -



A-160 Hummingbird

Autonomous Combat Operations with Unmanned Systems

C4ISR…assured comms and situational awareness

A-160 Hummingbird

Extended Range & Increased Payload

Organic Air Vehicle (OAV)

Extended Range and Endurance

Micro Air Vehicle (MAV) ACTD

Extended Loiter "Perch and Stare"

Survivability
FY05-09 $723M

Avoid threat detection and acquisition

Signature Manageme
Radar Deception

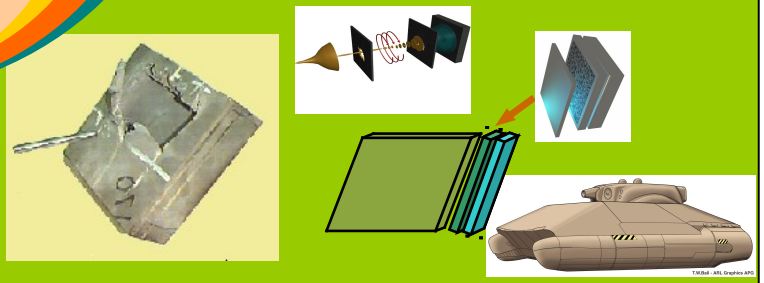
Mobility for the Unit of Action

Mine Detection & Neutralizatio

Intercept Direct and Indirect munitions

Full Spectrum
ive Protection,
Chemical Energy OTM
Kinetic Energy Static and OTM

Survive the hit

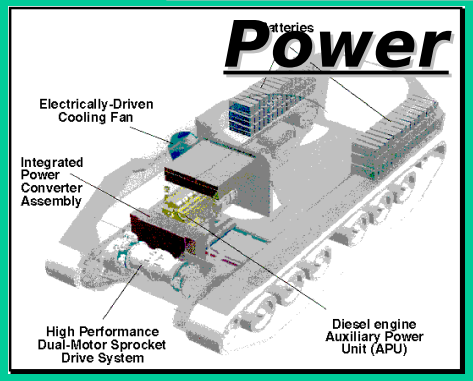


Armors: Structural, Electromagnetic, and Smart

Power and Energy Technologies

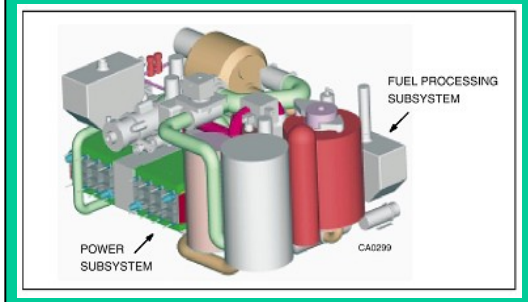
09 $647M

FCS Vehicle Power

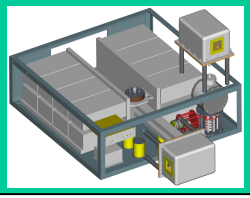

Batteries
Electrically-Driven Cooling Fan
Integrated Power Converter Assembly
High Performance Dual-Motor Sprocket Drive System
Diesel engine Auxiliary Power Unit (APU)

- *All Electric vehicles*
- *Fuel efficiency*
- *Silent mobility*

Hybrid Electric Drive



Diesel Reformer Power



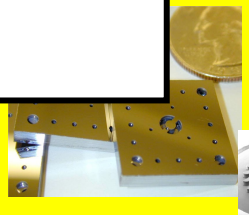
Pulse Power for...
Electric Weapons & Protection

6x Power Density

- *Minimize deployment time*
- *Self Sustainment*
  - *3 days - High optempo*
  - *7 days - Low optempo*
- *New capabilities*
  - *Lethality*
  - *Survivability*

Soldier System Power

- *Reduce weight*
- *Increased power*
- *Increased mission time*



Microturbine/ Microengines

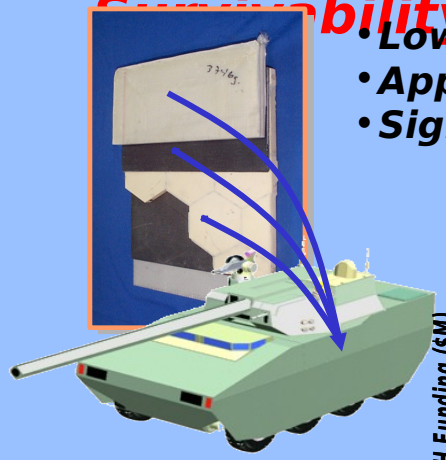
10x Power Density

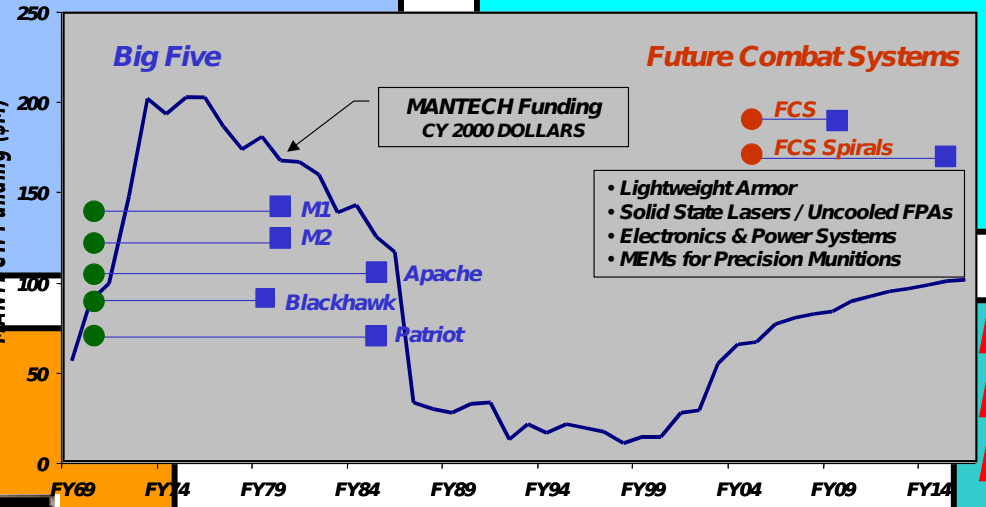
Manufacturing Technology

FY05-09 $390M

Armor -- Survivability

- Low-cost Composite
- Appliqué Armor
- Signature Management

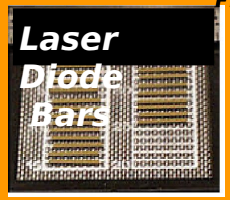




Electronics/Power Systems -- Networks

- Flexible Display
- S/W Radios
- Silicon Carbide Switches
- Phased Shifter

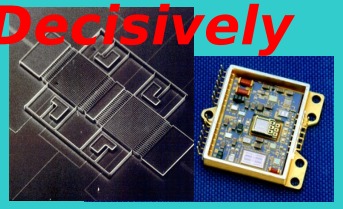
Sensors – See First



- Two Band FPA Cooled
- Laser Source Affordability

In 1990s $48M ManTech investment in JAVELIN resulted in estimated savings of $364M in production

Munitions -- Finish Decisively



MEMS-IMU GPS

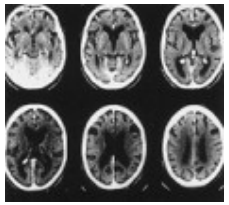
Basic Research…

The Next Generation of Paradigm Shifting Technologies

FY05-09 $1.6B

Decade of the 1970's

Structural Imaging



1971 – First Practical X-ray Computed Tomography Image

Artificial Intelligence

1970-Shakey the robot

Microprocessors

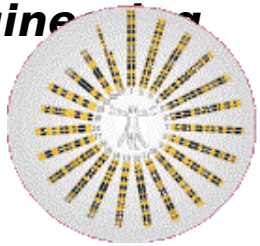
1971 – First 4 Bit Microprocessor in Production

Supercomputing

1975 – Cray I Supercomputer

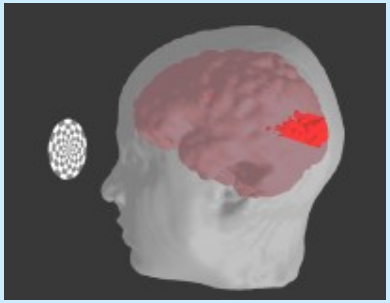
Arcade Games

Genetic Engine…



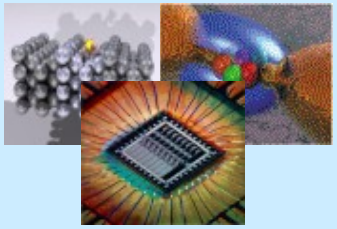
Today for 2020 and beyon

Functional Brain Imaging

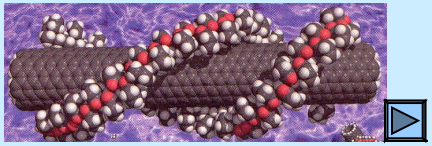


Robotics

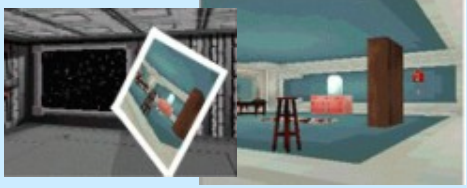
Quantum Computing



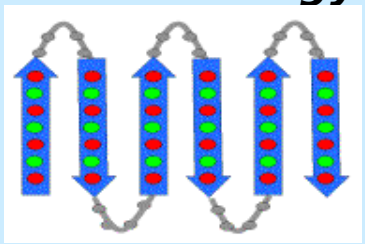
Nanotechnology



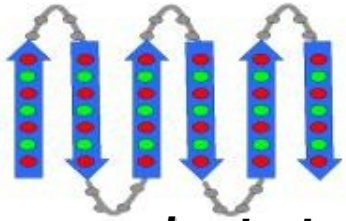
Immersive Environments



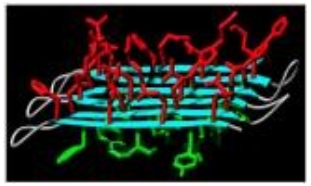
Biotechnology



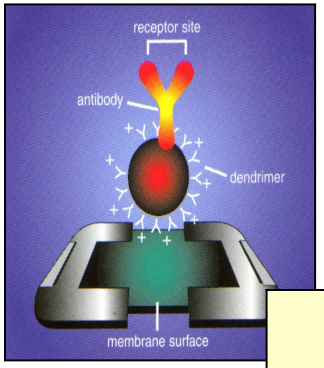
Institute for Collaborative Biotechnologies



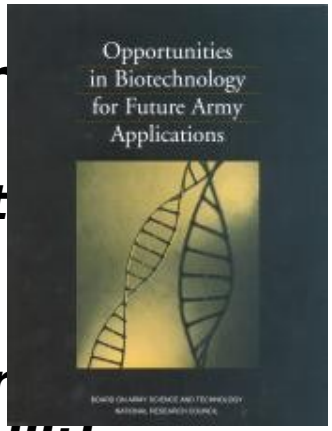
Binary code strategy to enable biologically-based production



Facial amphiphile



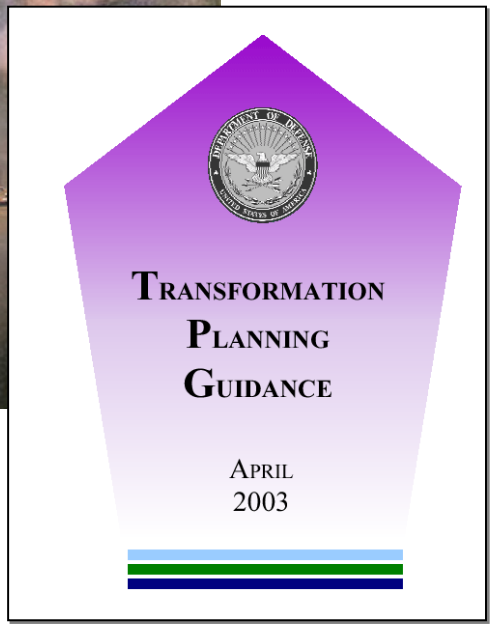
- *University-led center to integrate biosciences with the physical and engineering sciences*
  - *22 August 2003 Contract award of ICB – Lead: University of California at Santa Barbara (UCSB)*
    Partners: California Institute of Technology (Cal Tech)
    Massachusetts Institute of Technology (MIT)
- *Understanding of biological constr of novel materials to include:*
  - *Biologically-derived functional elect magnetic and optical materials*
  - *Integrated multi-modality sensing*
  - *Biologically-derived power and ener*
  - *Sense and respond actuation capabilities*



Gain insight from nature … for design principles, performance capabilities, and manufacturing possibilitie

The Army…
Transforming while at War

CKEM



"…we must achieve: fundamentally joint, network-centric, distributed forces capable of rapid decision superiority and massed effects across the battlespace."

Secretary Rumsfeld

"…a future force that is defined less by size and more by mobility and swiftness, one that is easier to deploy and sustain, one that relies more heavily on stealth, precision weaponry and information technologies."